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ABSTRACT

Implications of new government approaches to manpower planning and its relationship to higher education in Ontario are examined. In January 1980 the Council of Ontario Universities released a background paper on the employment of university graduates, which reviewed the current major economic and demographic analyses of youth unemployment, the employment experiences of university graduates, and projections of future demand for highly qualified manpower. The impact of perceived and actual employment problems of college graduates on education policy was also considered. More recent studies of the labor market show imbalances between university output and labor market demand. Emphasis has shifted from the plight of the unemployed or underemployed graduates to the economic impact of shortages of skilled and highly qualified manpower. Government reports have suggested that university programs and enrollments are more closely matched with labor market requirements. The effects of this viewpoint on Ontario universities and higher education in general are reviewed. Relevant sections of government reports and the rationale and techniques used to support this planned approach are analyzed. A bibliography is included. (Author/MSE)

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MANPOWER PLANNING AND HIGHER EDUCATION POLICY

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INTRODUCTION

In January 1980, the Council of Ontario Universities released a background paper on the employment of university graduates. "The University Graduate and the Marketplace" reviewed the major economic and demographic analyses then available concerned with youth unemployment, the employment experiences of university graduates, and projections of future demand for highly qualified manpower. The impact of the actual and perceived employment problems of university graduates on higher education policy was also considered. During the last year, a number of new studies of the labour market for university graduates have been published, and accounts of imbalances between university output and labour market demand have appeared frequently in the media. Emphasis has shifted from the plight of unemployed or underemployed graduates to the economic impact of skilled and highly qualified manpower shortages. Government reports have suggested that university programmes and enrolments be more closely matched to labour market requirements. This paper reviews the implications of that viewpoint, particularly for universities in Ontario. Relevant sections of government reports, and the rationale and techniques used to support a planned approach are analyzed.

1.0 MANPOWER PLANNING: CURRENT REPORTS AND ISSUES

1.1 Federal Manpower Policy in the November Budget

A basic statement on manpower planning and university education appears in last November's budget paper dealing with federal-provincial fiscal arrangements. After a proposal that "new arrangements for financing the post-secondary education and human resources development be devised, in consultation with the provinces", it is asserted that existing arrangements "are not consistent with the country's present or future needs."[1] These needs can be better met by more centralized planning aimed at matching postsecondary graduate supply with demand in the country as a whole:

> Canada's economic development depends increasingly on our ability to make the most effective use of our human resources. This will require better co-ordination of higher education and related activities. Federal support for human resources development should accordingly be reassessed. The issue is no longer simply growth and program expansion, but the focus and direction required to restore and maintain the vitality of Canada's economy. Concerted and sustained efforts are required to avoid university and college graduates finding themselves unemployed because of an over-supply of their particular skills, while industrial expansion is hampered by shortages of other skills. Although regional concerns remain important, long-term planning for the country as a whole has become vital, and the federal government has national responsibilities in this regard which cannot be ignored. Otherwise, potential waste through duplication and wasteful competition could impede efforts to accelerate growth of the Canadian economy. (p. 39)

This statement implies that future requirements for university

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1 Fiscal Arrangements in the Eighties - Proposals of the Government of Canada (Ottawa: Dept. of Finance, November 1981), p. 38.

trained manpower can be ascertained with sufficient detail and accuracy to improve the "focus and direction" of choices made by provincial governments, institutions, and the individual student. The concept of universities as primarily training institutions has been given increased emphasis in the last year. A number of arguments have been made to support this view of the universities' role:

1) Canada's economic development in the next decade will depend on availability of specific kinds of highly qualified manpower;
2) Demographic factors that produced a growing labour force in the sixties and seventies will cause a decline in total new entrants in the eighties. It is therefore essential that "wasteful" mismatches of manpower be avoided.
3) The employment problems faced by some university graduates in the seventies could have been avoided by better planning.
4) Universities and provincial governments have not been very responsible in developing human resources.

Since the universities (and the provinces) may be required to deal with as yet undefined measures aimed at better development of human resources, the arguments used to justify more emphasis on job training must be carefully scrutinized. How valid are methods used in evaluating university outcomes, such as graduate surveys and cost/benefit analysis? And, most important for the future: Are the manpower forecasting techniques now in use capable of providing the information needed to ensure better outcomes than in the past?

1.2 "Job Market Reality" and the Use of Graduate Survey Data

In March 1981, Statistics Canada published a study on graduate employment that had major implications for the proposed federal policy on manpower development. This report, Job Market Reality for Postsecondary Graduates, has been reviewed in detail in a COU paper.[2] Although the 1978 survey is an excellent base for future studies, and provides detailed information on the mid-seventies job market for college and university graduates, the analysis of the survey data in Job Market Reality is somewhat unbalanced. Certain highlights and conclusions overemphasize poor outcomes for graduates of non-vocational programmes. Since the report's primary goal is "to help senior secondary students who are considering career choices and options for further study",[3] its impact on these non-specialist readers is a major concern. Although the present generation of new postsecondary students will enter a job market that may be quite different from that faced by the 1976 graduates, some of Job Market Reality's conclusions about underemployment, plans for further education and the relationship of job to field of study give the impression that non-vocational programmes usually lead to disappointment, and vocational programmes, to success. Yet the data show that the reality is more complex.

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2 Laura Selleck, "Critique of Job Market Reality for Postsecondary Graduates" (Toronto: COU, June 1981).

3 W. Clark and Z. Zigmond, Job Market Reality for Postsecondary Graduates: Employment Outcome by 1978, Two Years after Graduation (Ottawa: 1981), p. 37. [4]Employment Survey of 1979 Graduates of Ontario Universities: Summary Report (Toronto: MCU, 1980).

Like the Ontario survey of 1979 university graduates,[4] the Statistics Canada survey found that in general, vocational university programmes led to low rates of unemployment and jobs more closely related to field of study. This usually correlated with higher salaries and job satisfaction, lower underemployment levels, and less regret over field choice. Yet there were enough results not consistent with this pattern to cause concern with generalizations derived from the study's data. For example, the underemployment rate was rather high for business graduates with bachelor's degrees, and a comparison of underemployment rates by occupation group (Table 1) shows unexpectedly high rates of underemployment for some jobs usually considered suitable for university graduates. One-third of elementary and secondary teachers with bachelor's degrees reported underemployment (as determined from responses to a question on the minimum education originally specified by employers for the job held in June 1978). In unpublished data from the 1980 survey of Ontario university graduates, 23.3% of bachelor's degree holders in the elementary and secondary teaching category reported, despite present teacher certification regulations, that a degree or diploma was not specified as a requirement for their most recent job.[5] But more surprisingly, 22% of

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4 Employment Survey of 1979 Graduates of Ontario Universities: Summary Report (Toronto: MCU, 1980).

5 Dr. J. Campbell Davis, Department of Sociology, Wilfrid Laurier University, provided supplementary data from the Ontario survey.

TABLE 1

SELECTED DATA ON 1976 BACHELORS' GRADUATES BY OCCUPATION GROUP

Responses of Graduates Employed Full-Time in June 1978
(Percentages unless otherwise indicated)

	SENIOR & MIDDLE MANAGERS	MANAGEMENT SUPPORT	PHYSICAL SCIENTISTS & TECHNICIANS	ARCHITECTS & ENGINEERS	MATHEMATICIANS, STATISTICIANS, COMPUT. SCI.	SOCIAL WELFARE, COMMUNITY SERVICE	LAWYERS & OTHER LAW OCCUPATIONS	ELEMENTARY & SECONDARY TEACHERS & REL.	VOCATIONAL, COM. COL & SPECIAL TEACH.	PHYSICIANS, DENTISTS & VETERINARIANS	NURSES & THERAPISTS	PHARMACISTS, DIETICIANS, OPTOMETRISTS	STENOGRAPHERS & TYPISTS	FINANCIAL & STATISTICAL CLERKS	GENERAL OFFICE CLERKS	SALES (COMMODITIES)	OTHER OCCUPATIONS	TOTAL
Number	2879	3168	543	2042	1158	1207	1627	14619	1894	1218	1201	918	515	1046	980	1365	10022	46409
Relationship of Job to Field of Study																		
A) Direct	26.4	38.9	43.4	53.2	39.7	37.2	69.3	55.5	47.0	91.1	68.0	61.9	15.5[Q]	24.1	6.2	9.8[Q]	19.3	41.3
B) Partial	51.5	45.3	45.9	40.6	52.4[Q]	51.6	22.5[Q]	33.9	40.1	--	27.0	29.6[Q]	26.4	35.4	33.6	46.3	41.7	38.3
C) Not Related	22.1	15.8	10.7[Q]	6.3	7.9[Q]	11.2	8.2[Q]	10.6	12.8	--	5.0	8.5[Q]	58.1	40.5	60.2	43.9	39.0	20.4
Underemployment	38.7	31.3	18.9[Q]	15.2	30.2	29.6	9.9	33.3	29.5	7.3[Q]	34.7	23.4	87.4	58.2	79.6	50.3	52.5	37.7
Dissatisfied with Job	11.1	11.6	10.4[Q]	11.9	5.9[Q]	8.6[Q]	--	6.2	9.8	6.6[Q]	15.4	13.1[Q]	38.3	26.4	43.6	16.1	20.8	12.7
Average Annual Salary ($)	15300	14000	14900	17500	15500	13400	16100	15600	15700	18300	14500	14600	9600	11600	10600	13600	13000	14800
Dissatisfied with Salary	20.8	27.3	15.1[Q]	19.8	17.8	28.0	22.3	10.4	13.3	24.7	22.6	17.9	35.8	34.7	22.5	18.1	23.5	18.7
Regret Choice of Field	28.8	28.8	31.0	17.5	24.1	26.1	7.0[Q]	20.9	22.5	7.9[Q]	16.9	20.9	45.6	39.5	40.2	37.0	33.2	25.5
Planning Post-secondary Enrolment in Next Two Years	56.1	47.2	47.5	45.3	43.2	52.6	29.0	53.6	55.6	38.1	42.7	41.2	50.0	50.0	53.6	45.6	51.3	50.5

-- = Extremely small sample size. Figures not published because of inordinately large sampling error associated with them.
Q = Relatively small sample size, resulting in less reliable estimates than those that are unmarked.

From: Job Market Reality for Postsecondary Graduates, Tables 138-154.

bachelor's graduates in clerical jobs and 18.3% in service occupations reported that a degree or diploma was required. How should these results be interpreted? Educational requirements for these latter jobs may be increasing. Some of the teachers may have jobs obtained before a degree was required for certification. The survey question may have been misinterpreted, or the job titles reported may have been miscoded and placed in the wrong occupational categories. Given these possibilities, survey results on underemployment and other more subjective variables must be interpreted with great caution.

Initial reservations about the appropriate use of graduate survey data have increased as the federal government's policy on manpower planning was revealed in the months following the publication of Job Market Reality. The Statistics Canada report has been used as evidence of an oversupply of university graduates and the low market value of general education. In retrospect, some conclusions seem designed to support a policy of tailoring university programmes to the requirements of the labour market. For example, Job Market Reality repeatedly claims that plans for additional education are largely due to the graduate's inability to find suitable employment. Although plans for further education are also reported by relatively successful graduates of job-oriented college and university fields,[6] the authors emphasize the public costs of professional or graduate education after a non-vocational first

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6 Results shown in Table 41 and Chart 7 of Job Market Reality.

degree:

> Another point concerns the high cost of postsecondary education. In a sense, taxpayers have to pay twice to educate many students who go back for retraining when they find that their first diploma or degree is no guarantee of early success on the labour market. (p. 157)

This interpretation conveniently overlooks the fact that many of the highly successful professional, masters and PhD graduates have first degrees in the humanities, social and pure sciences. This concern for the costs of general education fits in well with the new federal concentration on the narrow training function of higher education. The ready acceptance of Job Market Reality as the premier authority on employment of graduates points out the need for critical analysis of both the methodology and use of graduate surveys. If graduate surveys are used for counselling prospective students and reallocating education expenditure, the applicability of historical data to future labour markets must be considered. Economic conditions at the time of the survey are of primary importance. Was the mid-seventies labour market for graduates anomalous, or the beginning of a long-term trend? Can technical problems in conducting a survey or compiling the data colour the results? Is one or two years after graduation an appropriate time to be judging career outcomes, especially for graduates of non-professional programmes who may take longer to move into long-term career paths?

Survey results such as those presented in Job Market Reality should be placed within the larger context of an unprecedented number of total new labour force entrants from all levels of education, and a national economy growing at a less rapid pace than during the boom

years of the sixties. In a study of economic returns on undergraduate education between 1961 and 1972, Ozay Mehmet concludes that:

> demand factors, or more specifically changes in the level of Canadian GNP, were far more important than increased supply of university graduates entering the employment market, in explaining the dramatic shifts in the Canadian college labour market during 1961-72.[7]

Similarly, in a paper on occupational status attainment, Edward Harvey and Richard Kalva conclude that the weakness of the labour market has more effect on occupational status than the individual attributes of the graduates.[8] These findings suggest that the underemployment problem includes factors other than simply poor choices by students and poor planning by institutions.

The extent to which employment prospects at the time of a given survey will continue in the future is also uncertain. Engineers, for example, were in high demand in 1976, as shown by the consistently favourable position of engineering graduates. Yet the market for engineers can be altered very rapidly by changing economic conditions. Job prospects for other graduates may improve. For example, the 1978 survey showed high rates of

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7 "Economic Returns on Undergraduate Fields of Study in Canadian Universities: 1961 to 1972", Industrial Relations Industrielles, 32 (1977), 335-36.

8 "Occupational Status Attainments of University Graduates: Individual Attributes and Labour Market Effects Compared." A paper submitted to the Canadian Review of Sociology and Anthropology (Toronto: 1981).

unemployment and comparatively low salaries for both college and university graduates in humanities and fine arts. Yet a recent projection of occupational demand through 1985 says that need for people in the performing arts and writing, as well as for engineers and scientists, will continue to grow faster than average.[9] Among the specific occupations projected to have strong demand are those in fine and commercial art, photography, painters, interior designers and advertising artists. If these projections are accurate, it seems that students should not be discouraged from choosing art courses. In this case, which information is a better basis for programme choice, the survey or the forecast?

Surveys of graduates have tended to ignore educational variables apart from discipline and degree level. It would be useful to know more about the characteristics of graduates from the same field who were successful or unsuccessful. Paul Anisef's cohort survey found that obtaining high grades was related to a positive evaluation of major field in terms of job preparation. A majority of university and CAAT students who earned As and Bs believed their majors or specializations were very valuable or valuable; the opposite was true for students whose grades were C or less.[10]

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9 Canadian Occupational Forecasting Program (COFOR), Occupational Requirements to 1985 (Ottawa: Employment and Immigration Canada, 1981), pp. 11-12.

10 Paul Anisef, V. Gottfried Paasche and Anton H. Turrittin, Is the Die Cast? Educational Achievements and Work Destinations of Ontario Youth (Toronto: M. of Ed./MCU, 1980), p. 238.

We also need to know more about the relationship between jobs held one or two years after graduation and long-term career prospects. Statistics Canada's 1973 Highly Qualified Manpower survey showed that apart from the professions, most highly-qualified occupations are not education-specific. Liberal arts graduates have traditionally gone into jobs unrelated to their undergraduate majors and have been successful and satisfied. A U.S. survey of university graduates, selected by employers because of their effective performance on the job, found that the development of general analytical and problem-solving abilities was a more important contribution of higher education than knowledge of a specific occupational field.[11] English and psychology were cited as courses having particular applicability to success in the work environment.

Unfortunately, some present day employers seem less appreciative of the general competencies traditionally associated with the liberal arts. Although senior corporate officials may sometimes express a preference for liberal arts graduates who can think and communicate[12] people who are actually hiring new graduates usually find it easier to employ graduates with specialized skills. The increasing availability of graduates with these qualifications probably means even less opportunity for the non-vocational

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11 Ann S. Bisconti, College and Other Stepping Stones: A Study of Learning Experiences that contribute to Effective Performance in Early and Long-run Jobs (Bethlehem, P.A.: CPC Foundation, 1980), p. 77-79.

12 See, for example an article on M.B.A.s in Time, May 4, 1981.

graduate. The realities of the marketplace will not be ignored by prospective students. An alternative to total career-oriented education is a general/vocational major which might include administration and commerce courses and a broad background in social science. Similar programmes could be developed using humanities or natural sciences in combination with more job-related courses.

The accommodation of enrolment shifts toward more applied fields and the introduction of combined programmes is evidence that universities have not been unresponsive to the needs of the larger economy. Universities in Ontario are nearly stretched to capacity in providing spaces for undergraduate students in job-related fields such as engineering, commerce and computer science. A background paper by the Ontario Council on University Affairs concluded that expansion of undergraduate degree output from these programmes is now clearly constrained because of shortages of faculty.[13] Rather than criticizing universities for not producing enough bachelor's degrees in engineering, computer science and commerce, government and industry should be concerned with the more critical problem of declining graduate enrolments in the pure and applied sciences. At the higher degree levels, where less substitution is possible, shortages of trained researchers and university faculty will seriously impede the development of high-

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13 Advisory Memorandum, 81-V, "Supply of and Demand for Graduates in Certain Professional Programs in Ontario". (Toronto: OCUA, 1981).

technology and energy projects.[14] There are many reasons for declining graduate enrolment in engineering, computer science, the physical sciences and business, but certainly a major factor has been the relatively unattractive prospect of employment in underfunded universities. When industry offers high salaries to new bachelor's graduates, there is little incentive to continue education for several years if the only reward is a faculty position at a not much higher salary and the frustration of shortages of equipment and research money. Special funding for certain faculties and disciplines has been suggested in order to produce more undergraduates. In the universities, however, professional faculties and the basic arts and sciences are interdependent. The expansion of high demand undergraduate programmes cannot take place rapidly or in isolation from the rest of the university.

1.3 The Dodge Report

The view of universities as primarily training institutions, with some sectors more deserving of support than others, has been put forward by the federal government in the context of a more general analysis of labour market requirements. Labour Market Development in the 1980s, usually called the Dodge Report after its principal

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14 Dr. G.M. MacNabb, President of the Natural Sciences and Engineering Research Council, estimates that if graduate enrolments continue to decrease, there will be a shortage of approximately 1,000 natural science and engineering postgraduates per year through 1985. From "A Shortage of Trained Researchers - Real or Imagined?", addressed to the Annual General Meeting of SCITEC, Nov. 9, 1981.

author, was published in July 1981.[15] Its suggestions and proposals, according to a Foreword by the Minister of Employment and Immigration, "do not represent the policy of the Government of Canada." They are instead based on analytical work by the Task Force on Labour Market Development and are put forward "as a contribution to the process of consultation" with provincial government and organizations in the private sector. Although its individual recommendations may not be accepted government policy, the findings of the Dodge report are obviously in the background of the Budget statement on more involvement in postsecondary planning, cited at the beginning of this paper.

Labour Market Development employs "top-down" forecasting methods to derive estimates for occupational requirements in the eighties. The analysis of the labour market begins with industrial output projections for the Canadian economy. These projections assume an increasing output from the goods-producing and export sectors, particularly those tied to energy development in Western Canada. Employment growth is expected to increase in these sectors, which require skilled tradesmen and university graduates from technical fields, with correspondingly less employment in the service sector, particularly in education and health care.(p. 53)

The technical report used in the chapter on macroeconomic

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15 Labour Market Development in the 1980s: A Report of the Task Force on Labour Market Development. (Ottawa: Employment and Immigration Canada, July 1981).

projections states explicitly the reasons for reduced growth in the service sector:

> . . . we expect a sharp slowdown in the rates of growth of both the publicly-provided services sector (health and education) and the public administration sector, reflecting both demographic trends and continuing expenditure constraint at all levels of government.[16] [my underlining]

Whether the goods sector will grow as rapidly as government planners would like, and whether the real need for publicly provided services will decline are not at issue here. These assumptions are basic to the occupational projections used by the Task Force. With the exception of engineering and scientific occupations, the estimates for employment growth in the 1970s and the 1980s (Tables 2 and 3) show declines in the contribution to employment growth of highly qualified occupations requiring university education. Even managers and administrators are expected to be in less demand than in the recent past. The Task Force authors suggest that this may be related to slower service industry growth.(p.53) On the other hand, skilled occupations, particularly in construction, are expected to contribute more to employment growth than they did in the 1970s.

There are admissions of the limitations of occupational projections in the Task Force report's chapter on labour markets in 1980's. The problem of industry-occupation coefficients is identified, for

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16 Informetrica Ltd., Canadian Labour Markets in the 1980s: A Macroeconomic Overview, Technical Study 18 for the Labour Market Development Task Force (Ottawa: July 1981), p. 40.

TABLE 2

Occupational Composition of Employment Growth (per cent contribution to overall employment growth)

	1972-79	1980-85				1986-90	
		A	B	C	COFOR-85	A	B
Highly qualified occupations	19.1	13.2	13.0	14.4	11.6	13.9	14.0
Highly skilled occupations	27.0	24.4	24.5	27.7	28.9	27.6	27.3
Medium skilled occupations	23.8	29.6	29.6	28.0	26.0	30.0	30.3
Low skilled occupations	30.2	32.7	32.9	30.0	33.4	28.5	28.4
Total employment	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Estimates made by the Task Force using COFOR model and different macro scenarios. COFOR-85 data from Dept. of Employment and Immigration, *Occupational Requirements to 1985*, February 1981.

From: Labour Market Development in the 1980s, Table 4-6, p. 53.

TABLE 3

Occupational Composition of Employment Growth — Highly Qualified Occupations (per cent contribution to overall employment growth)

Occupation	1972-79	1980-85				1986-90	
		A	B	C	COFOR-85	A	B
Managers, administrators and related occupations	8.2	5.3	5.2	5.2	5.2	5.4	5.6
Engineers, architects, system analysts, occupations in the physical and life sciences and in mathematics and related fields	1.7	1.9	1.8	2.0	2.5	2.4	2.6
Occupations in the social sciences and related fields (lawyers, social workers, economists, sociologists, librarians, etc.)	1.8	1.5	1.5	1.6	1.3	1.7	1.7
Teaching and related occupations	5.2	2.8	3.1	3.6	1.3	2.4	2.3
Doctors, dentists, veterinarians and other health diagnosing and treating occupations	1.2	0.8	0.7	0.9	0.6	0.6	0.6
Other highly qualified occupations	1.0	0.9	0.7	0.9	0.8	1.4	1.2
Total highly qualified occupations	19.1	13.2	13.0	14.4	11.6	13.9	14.0

Source: Estimates made by the Task Force using COFOR model and different macro scenarios. COFOR-85 data from Dept. of Employment and Immigration, *Occupational Requirements to 1985*, February 1981.

Occupational Composition of Employment Growth — Highly Skilled Occupations (per cent contribution to overall employment growth)

Occupation	1972-79	1980-85				1986-90	
		A	B	C	COFOR-85	A	B
Occupations in architecture and engineering other than architects and engineers (draughtsmen, architectural and engineering technologists and technicians)	1.6	1.2	1.2	1.3	1.5	1.5	1.5
Occupations in health other than diagnosing/treating (nurses, physiotherapists, etc.)	5.2	4.6	5.0	5.2	4.7	2.9	2.9
Highly skilled occupations in sales (technical salesmen and advisers, insurance salesmen, real estate salesmen, etc.)	10.2	8.3	8.2	9.8	10.0	11.4	10.6
Highly skilled construction trades occupations (construction electricians, plumbers, carpenters, etc.)	3.6	4.7	4.7	5.9	7.1	5.5	5.8
Highly skilled processing occupations (tool and die makers, machinists, mechanics, etc.)	4.9	4.5	4.4	4.5	4.4	5.2	5.2
Other highly skilled occupations	1.5	1.0	1.0	1.0	1.1	1.1	1.2
Total highly skilled occupations	27.0	24.4	24.5	27.7	28.8	27.6	27.3

Source: Estimates made by the Task Force using COFOR model and different macro scenarios. COFOR-85 data from Dept. of Employment and Immigration, *Occupational Requirements to 1985*, February 1981.

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From: Labour Market Development in the 1980s, Tables 4-7 and 4-8, p. 54.

example:

> The only available information on employment by occupation within each industry relates to a single point in time, so that we do not know the extent to which changes in the skill and occupational mix within industries have occurred in recent years. . . .our projections of occupational demand reflect only the effects of the changing industrial composition of employment growth. (p. 52)

Another area of uncertainty is matching supply and demand sides:

> In the case of demand for and supply of workers to particular occupations, our information is incomplete for both past and future periods. With respect to the numbers of people employed in particular occupations in recent years, we are forced to estimate the occupational distribution of employment within industries on the basis of information collected in the early 1970s. On the supply side we have very little information on the amount of emigration by occupation and we have none on the extent to which inter-occupational mobility has occurred. (p. 65)

In spite of these reservations, the Dodge report calls for more centralized educational planning to meet projected labour force requirements.

Chapter Nine,"Training to Meet Skill Needs" evaulates the role of postsecondary institutions in providing highly qualified manpower, and makes a number of recommendations. Federal involvement in training for highly qualified and skilled occupations is examined, with the analysis centering on two basic questions:

> How efficient has the training system been in meeting skill needs and satisfying equity objectives?
>
> What modification in the federal government role is required to ensure that the system can meet the changing skill needs of the 1980s? (p. 153)

The section on highly qualified occupations requiring education in universities and colleges is based on a technical report by

University of Toronto economist David Stager.[17] Although the text of the final report follows Stager's work, there are some omissions of materials that might have been seen to contradict the Task Force's recommendations on reduced support for university-level training. The Task Force acknowledges that it is concerned with only one aspect of higher education:

> Our analysis applies to only one component of post-secondary education - that which is directed at producing skills for the labour market. The achievement of other social goals may well warrant a different allocation of resources to the post-secondary system than that required for training purposes, and our discussion must be read with this caveat in mind. (p. 153)

Unfortunately, the budget statement on federal transfers for post-secondary financing seems to ignore this caveat and focus entirely on the human resource development function. The universities are concerned with the Task Force assumption that training for the labour market can be separated from the total function of higher education. An AUCC response to the Dodge report points out that universities have a core element providing research, scholarship and teaching in the humanities, social and natural sciences, and closely associated elements which include the professional faculties and schools.[18] These elements are interdependent and are

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17 Federal Involvement in Post-Secondary Education for Highly Qualified Labour (Parts I and II), Technical Study 35 for the Labour Market Development Task Force (Ottawa: July 1981).

18 AUCC Response to the Task Force Report on Labour Market Development in the 1980s (Ottawa: Assoc. of Universities and Colleges of Canada, 19 Nov. 1981).

equally essential for the development of highly qualified manpower:

> Because education and training are inseparable components of a students learning experience at a university, one cannot practically support only the training component of an educational program. Similarly, because of the symbiotic relation between the university's core element and its associated professional faculties or schools, there are severe limitations on the effectiveness of increased support for associated professional programs if the core element is not also supported.[19]

In other words, analysis of the training function alone is necessarily artificial and incomplete. Notwithstanding, the Task Force uses this fragmented approach to support conclusions that would seriously affect university education.

The technical part of the Task Force's section on postsecondary training employs four techniques for evaluating "the efficiency aspect of resource allocation decisions":

1. benefit/cost analysis for both individuals and society;
2. relative earnings of graduates in various occupations and disciplines
3. unemployment and job vacancy rates; and
4. forecasts of excess supply or demand.(p. 153)

The evidence derived from these methods (and from labour market analyses elsewhere in the report) lead to five major conclusions:

- Some reduction of the total commitment of resources to post-secondary training would be appropriate in order to free resources for other types of training.
- Significant reallocation of resources is required

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19 Ibid., pp. 3-4.

within the post-secondary system. . . .

- Although reallocation of resources within the post-secondary sector is required, excessive contraction of specialized facilities and faculty must be avoided.

- Because the demand for highly qualified labour in Alberta and British Columbia will exceed by far the supply of graduates from those provinces. . . . the number of new graduates in business, engineering, the technologies and pure science in central and eastern Canada should be planned to exceed the demand in this part of the country.

- Some shifting of the burden of financing post-secondary education back to the private sector would promote a better allocation of resources across disciplines and between post-secondary training and other competing investments . . . . (p. 157)

The Task Force then considers changes in policy that would encourage universities and colleges to be more responsfve to labour market conditions. The federal government could contribute:

> by ensuring the provision of good labour market information to the institutions and to students;
>
> by better management of the demand for labour for research and development and for the federal public service; and
>
> by making its contribution to financing of training at the post-secondary level in a more appropriate manner. (p. 158)

Only the third point is discussed in detail. Measures suggested for "more appropriate" financing include using some portion of federal expenditure for maintaining the academic base in disciplines currently not in high demand; using increased tuition fees and targeted student aid to make institutions more responsive to student demand for job-related training; and encouraging institutions to tap other sources of private funding. The assumptions behind the second and third suggestions are that more money would be directed to training rather than general education, and the

private sector (students and industry) would be more realistic and responsive than institutions now are. Additional areas for federal government involvement would be research costs, and "some form of thrust funding or adjustment assistance for the institutions, to encourage the expansion of physical plant and human resources in disciplines in high demand". The exact nature and extent of these measures would apparently be worked out in consultation with the provinces and the institutions, as suggested in the budget document on transfer financing.

The evidence for the Task Force's major recommendation, a reduction in the total commitment of resources to post-secondary training, and significant reallocation of resources within the post-secondary system, comes from four methods of assessment, no one of which, according to the Task Force "produces highly reliable results." (p. 157) Benefit/cost analysis, using both private and social costs, showed a decline in social and private rates of return to university training in the seventies, when compared to the sixties. There were also significant differences in returns across fields. Not surprisingly, returns were highest for the professions, particularly dentistry, medicine, law and engineering. The Task Force admits that since no analysis of changes in returns in Canada exist after 1972, "it is difficult to draw firm conclusions from this analysis." (p. 154)

In his technical paper, David Stager lists some caveats and objections to benefit/cost analysis as a technique for evaluating education expenditure. These include the quality of earning data,

the fact that earnings and cost data are average rather than marginal, the omission of externalities (benefits apart from lifetime earnings) from the calculation, monopolistic effects in professional labour markets, and lack of measures for effects of ability and further learning.[20]

Despite these reservations, the Task Force report concludes:

> That the overall size of the post-secondary sector is too large and . . . that it could be contracted somewhat, with resources modestly reallocated from education, general arts and sciences and social work to engineering, business, economics and technology. (p. 154)

This conclusion differs from Stager's on the possibility of over-investing in education:

> Although returns to education have declined in the past decade, this is not sufficient reason to argue that there has been "overinvestment" in education. To repeat, it is a matter of comparing expected returns across alternative investment projects. Although the rates of return are expected to decline still further, the declining relative earnings for college graduates are expected to reduce the proportion of college graduates in the labour force, followed by a gradual improvement in relative earnings and rates of return.(p. 124)

Stager does not conclude that "the overall size of the post-secondary sector is too large". He warns against drastic policy changes, and sees some evidence for "modest shifts" to fields that have historically had high rates of return.

> This suggests that public priority should not react in quantum leaps as it did in the early 1960s when it increased post-secondary facilities and financing so abruptly. In fact, there may already have been an excessively strong contractionary reaction to the

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20 Stager, Federal Involvement in Post-Secondary Education, pp. 108-11.

unexpected "dip" in university enrolments in the early 1970s.

> The difference in rates of return to different fields or occupations - even after adjusting earnings for the effects of imperfect labour markets - suggest that modest shifts in resource allocation towards health, business and technology may be warranted. (p. 124)

His recommendation is for allocation towards certain fields, not" reallocation from education, general arts and sciences and social work," as in the final Task Force report. Stager also argues that a rigid planned approach may not produce the desired results. In fact, it may be wiser to err on the side of overinvestment. He cites a U.S. manpower study:

> The cost to the economy of an inadequate supply of educated persons is probably greater than the expenditure of resources involved in creation of an excess of graduates beyond the needs of the economy, and in this sense an over-expanded educational system is less costly than an underdeveloped one.[21]

The Task Force report appears to be very selective in its use of Stager's background report. The evidence for declining investment in post-secondary education is accepted without much consideration of Stager's caveats. It is assumed that adjustments in the supply of graduates will produce the desired result i.e. higher returns on public investments as measured by aggregate private salaries. However, economists who have done cost/benefit analysis do not recommend adjustments of this kind. Ozay Mehmet argues that economic conditions in the early seventies were responsible for

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21 John K. Foger, Helen S. Astin and Alan E. Bayer, Human Resources and Higher Education (New York: Russell Sage Foundation, 1970), p. 42 Quoted in Stager, p. 125.

much of the decline in private returns to investment in university education. Although he did not attempt to calculate social rates of return for undergraduate fields (because of the near impossibility of identifying and measuring social benefits), Mehmet concludes that policy measures to adjust the supply of graduates may not have the desired effect because of the complex dynamic nature of the graduate labour market.[22]

The logic of adjustments based on benefit/cost evidence is also not followed consistently. The Task Force sees a need to shift resources to engineering, business, economics and technology, but not medicine, law and dentistry, the fields having the highest rate of return. Stager sees a possible need for modest shifts towards health, business and technology. Apparently health was dropped from the final report since an earlier chapter on labour market projection had forecast reduced need for health occupations because of reduction in government expenditure.

The evidence of graduate surveys is also used to support reallocation of postsecondary expenditure. The Task Force uses a table from Job Market Reality for Postsecondary Graduates to identify fields having the best returns. The shortcomings of graduate surveys in general and of this one in particular have already been discussed and will not be repeated. Again the Task Force acknowledged that the data had to be used with caution.

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22 "Economic Returns on Undergraduate Fields of Study", 337.

The other methods used by the Task Force for assessing the allocation of training resources are also inconclusive. Evidence is presented of a decline in starting salaries of university graduates compared to the average industrial wage. Other studies have produced similar results, but as the Task Force admits, the decline probably represents a return to a pattern of relative salaries more typical of the 1950s and 1960s (p. 157). Paul Davenport points out the fallacy of comparing starting salaries of university graduates with the salaries of experienced workers. Examining the average earnings of all university graduates relative to the average earnings of secondary school graduates, Davenport sees little change between 1959 and 1978. He also sees a return to a historically typical pattern after the anomalous sixties.[23]

The fourth method for evaluating the appropriateness of the level of postsecondary financing is the use of forecasts of supply and of demand for university graduates. The Task Force shows, on the supply side, a high proportion of university enrolments in arts, science and education in 1960, 1970 and 1977. These figures are highly aggregated and do not adequately reflect the shift in enrolments to more applied disciplines that has occurred in recent years. Even though a majority of students may still be enrolled in

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23 Paul Davenport, "Federal Funding of University Education," in Financing Canadian Universities: For Whom and By Whom?, ed. David M. Nowlan and Richard Bellaire (Toronto: U of T Insti. for Policy Analysis, 1981). p. 16.

arts, science and education, there is no reason to assume they will be unemployable. The rudimentary treatment of the subject in the Task Force report seems to take an all or nothing approach. Shortages for engineers, technologists and systems analysts are forecast (from the evidence of occupational projections in Chapter Four of the report), but there is no discussion of possible short-term solutions, such as retraining natural science graduates to fill some of these positions.

Although the Task Force admits that "the shortfall in terms of numbers of engineers or scientists is extremely difficult to quantify" (p. 157), the recommendations for significant reallocation of resources to specific disciplines apparently assume that detailed requirements can be accurately forecast.

1.4 The Allmand Report

Work for Tomorrow, the report of the Parliamentary Task Force on Employment Opportunities for the 80s, was published in October 1981, a few months after the more widely publicized Dodge report. In many ways the work of the Parliamentary Task Force (known as the Allmand report) complements that of the Employment and Immigration Task Force. It is concerned with possible shortages of skilled and highly qualified labour in the coming decade, and with a continuing problem of unemployment. Like the Dodge report, the Allmand report considers the reasons for both unemployment and skill shortages, their impact on the total economy, and ways to improve the situation. Unlike the Dodge report with its macroeconomic forecasts, the Parliamentary Task Force used a "bottom-up"

approach, interviewing industry, labour and professional association representatives to identify the nature and extent of current and future imbalances. A wide range of occupational imbalances were identified with this admittedly subjective method of investigation.

Although the Allmand report makes a number of specific recommendations that are direcly relevant to higher education policy, its position on the use of occupational forecasting appears to be at odds with both the budget statement on postsecondary financing and with the Dodge report's general acceptance of forecasting for detailed educational planning:

> The evidence presented to us by experts strongly suggests that the data currently available are poor, and the methodology not sufficiently well developed to provide useful projections of these variables. Available projections are not by themselves useful for policy-making since there are no accurate projections of the supply of people to different occupations. It is therefore not possible to use them alone to point out potential job shortages and surpluses of manpower.[24]

The Allmand report is critical of forecasts produced by Employment and Immigration's COFOR model since they do not incorporate adjustments made by employers and workers to changing conditions. In the words of the Parliamentary Task Force, forecasts from existing occupational models "are not very useful in decision-making, and they may seriously mislead planners and individuals."(p. 57)

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24 Work for Tomorrow: Employment Opportunities for the '80s, Parliamentary Task Force Report (Ottawa: House of Commons, 1981), p. 37.

While calling for improved methods for producing and disseminating labour market information, Work for Tomorrow points out the problems that may result from overreaction to anticipated shortages:

> The conclusion to be drawn from such past experience is straightforward: The system producing specific job skills in response to anticipated shortages must temper its exuberance or be faced with continuing cyclical fluctuation in labour supply and demand - complete with economic inefficiency. (p. 47)

The individuals and groups furnishing information to the Parliamentary Task Force apparently did, however, favour more job-related university programmes. The report recognizes, but does not highly value, general education:

> With respect to general education, we do not suggest that it is not valuable to develop the complete person and prepare individuals for the many challenges in life. But we should recognize that general education, whether in high school or at the B.A. and B.Sc. level, is not necessarily a ticket of admission to the labour market. Employers want and need skilled people. It is true that the rate of employment is much higher for university graduates than for others; but it is still higher for those with high- skilled training, whether from technical colleges, apprenticeship programs or universities. The best combination would be general education plus skills training. (p. 67)

On the subject of Established Programme Financing, the Task Force opposes overall cuts in postsecondary expenditure:

> If the Federal Government were to cut back this support at the present time in the hope that more resources would be contributed by the provinces, they would be taking a great risk with Canada's economic and industrial future. If the Government really believes that we must do something to ensure a greater supply of highly skilled labour and professionals in Canada, then there is no choice but to continue supporting post-secondary education. (p. 85)

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However, like the Employment and Immigration Task Force, the Allmand report favours reallocation of resources toward programmes expected to be in most demand in the 1980s. Recommendations are also made to improve apprenticeship training for highly skilled occupations. A levy grant system is suggested as the best method for overcoming the traditional reluctance of industry to initiate training programmes. Specific recommendations are made to provide more engineers, managers and nurses. The report notes that enrolments in engineering and management are constrained by shortages of faculty. Engineering and business graduates have no incentive to earn doctorates because the salary differential between university job and bachelors level jobs in industry is low. Among the measures suggested to correct this are a market premium for engineering faculty, more use of part-time faculty from industry, better use of technicians and technologists, and more in-house training by industry (p. 104).

1.5 Labour Market Projections for Ontario

In January 1982, another labour market study was released, this one by the Ontario Manpower Commission, a branch of the Provincial Ministry of Labour.[25] Labour Market Outlook for Ontario is a useful addition to the three major federal studies, since it explains in some detail the methods used to project both supply and demand sides of the labour market. Projections of Ontario's

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25 Farid Siddiqui, Ray Vafa, C. Y. Hsu and Brinda Murti, Labour Market Outlook for Ontario, 1981-1986 (Toronto: Ontario Manpower Commission, November 1981).

labour requirements through 1986 (described in Chapter I of the report) are derived from three macroeconomic scenarios using the University of Toronto's FOCUS model. Another University of Toronto model is used to derive projections for industry sectors in Ontario. Job openings due to growth and replacement are calculated by industry for total blue and white collar occupations. These are then subdivided by education or training level.

A similar multi-step process on the supply side (Chapter II) begins with Statistics Canada projections for the total Ontario population. The labour force stock for each year in the forecast period is calculated using working age population estimates and labour force participation rates by age and sex. The difference in stock in each year represents net additions to the labour force, which are further subdivided by source, including the formal education sector. Historical data on graduates and non-graduates from each level of education, and the proportions of each expected to enter the work force are used to estimate numbers of persons with different qualifications available to the labour force. Supply estimates are also derived from other sources: apprenticeship and training programmes; interprovincial and international migration; and the household sector. These estimates are more tenuous, since historical data are less readily available.

The Manpower Commission's projections, as the above synopsis shows, are developed through a number of successive and interdependent modelling exercises. Like similar labour projections they are subject to the margins of error inherent in the existing method-

ology, which will be examined later in this paper. The authors of Labour Market Outlook acknowledge that their projections "are not a statement about what will happen, or what should happen. They are a conditional statement about what may happen if the underlying assumptions hold."(p. 2)

Chapter III discusses imbalances between anticipated supply and demand, and the policy implications of these imbalances. This part of the report's analysis is the most subject to error and misinterpretation, for it compares two sets of estimates disaggregated into seven levels of education and training. The four education clusters used to categorize white collar occupations were developed in consultation with the Ministry of Education, using the standard CCDO classifications.[26] However, the actual occupations in each cluster are not identified, and the largest grouping for white collar jobs requiring postsecondary education is "occupations primarily filled by university or college graduates or certified professionals". As can be seen in Table 4, this grouping is projected to have 143,100 openings in a medium growth scenario, with 44,300 openings in occupations primarily filled by university graduates and 75,300 in occupations primarily filled by college graduates. On the supply side, the authors estimate a total of 133,500 university graduates and 96,800 college graduates becoming available during the projection period, plus an additional 6,500

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26 Manpower and Immigration, Canadian Classification and Dictionary of Occupations 1971 (Ottawa: Information Canada, 1971).

TABLE 4

A COMPARISON OF PROJECTED REQUIREMENTS AND SUPPLY BY LEVEL OF EDUCATION: ONTARIO 1981 TO 1986

Projected Total Job Openings: 1981 - 1986				Projected Total Labour Supplies: 1981 - 1986						
Education Level	Low Growth	Medium-Growth	High-Growth	Education Level	Formal Education Sector	Apprentice-ship & Modular Training	Armed Forces	Net Migration	Household Sector	Total
White-Collar Occupations: Total	542,600	566,300	580,600	White-Collar Occupations: Total	474,700	-	8,800	16,300	229,300	729,100
Primarily filled by University graduates	42,500	44,300	45,400	University Graduates	112,300	-	2,200	2,200	16,800	133,500
Primarily filled by University or College or Certified Professionals	137,100	143,100	146,700	University or College Graduates	-	-	-	6,500	-	6,500
Primarily filled by College Graduates	72,200	75,300	77,200	College Graduates	65,700	-	-	2,500	28,600	96,800
Normally not Requiring College or University Graduation	290,800	303,500	311,200	Some Post-Secondary Education & Secondary-School Graduates	296,700	-	6,600	5,100	183,900	492,300
Blue-Collar Occupations: Total	378,800	403,500	417,600	Blue-Collar Occupations: Total	172,400	52,800	15,200	-1,400	89,700	328,700
Highly Skilled	98,800	105,200	108,900	Highly Skilled	1,500	52,800	8,700	-2,200	-	60,800
Medium Skilled	50,900	54,200	56,100	Medium Skilled	4,500	-	6,500	-1,500	-	9,500
Low Skilled	229,100	244,000	252,600	Low Skilled (less than Grade 12)	166,400	-	-	2,300	89,700	258,400
Other "Unspecified" Occupations	49,900	51,400	53,000							
Total Job Openings: 1981-1986	971,200	1,021,200	1,051,200	Total Labour Supplies: 1981-1986	647,100	52,800	24,000	14,900	319,000	1,005,000[a]

[a] The individual row and column totals do not add up to the grand total. For explanation please refer to footnote in Table 42.

From: Labour Market Outlook for Ontario, 1981-1986, Table 45, p. 90.

migrants with unknown levels of postsecondary education. Unfortunately, the design of this table and certain aspects of the accompanying text invite comparisons between the projected openings in occupations " primarily filled by university graduates" and the projected total for university graduates. The inference that only the first white-collar category is appropriate for university graduates appears initially in the Summary and Conclusions section that prefaces the report:

> The overall supply of university graduates would far exceed the projected requirements. However, this does not necessarily mean that unemployment among university graduates will increase. It is more likely that they will take jobs not requiring a university degree. (p. iii)

Since the report does not identify the occupations included in the large university/college/certified professional cluster, it cannot be assumed that university graduates would be underemployed in these jobs simply because college graduates may also be qualified to hold some of them. At a more aggregated level, openings for postsecondary graduates are projected to exceed anticipated supply even in the low growth scenario. Although this is one of the most significant finding of the report, the prospect of university graduate underemployment is given more emphasis, with data from Job Market Reality, the 1979 Ontario survey and Is the Die Cast? introduced to support the Manpower Commission's projected imbalance. Missing from the underemployment data is the fact that Anisef et al found even higher rates of underemployment for college

than for university graduates.[27]

This apparent imbalance between university graduate supply and demand is only one part of the Manpower Commission's report, but it has received considerable publicity.[28] Misinterpretation of the university graduate supply/demand imbalance could have been avoided if the authors had not directly compared the projected supply of graduates with the rather narrowly defined cluster of occupations "primarily filled university graduates" when in fact many graduates will be suitably employed in the much larger second occupation category. Unfortunately, as was the case with Job Market Reality, labour market analyses from government agencies like the Ontario Manpower Commission are cited as authorities, without much consideration of the inherent limitations of projection methodology or the necessarily conditional nature of forecasts based on assumptions about future economic conditions. Since the concept of education planning based on occupational projections seems to have wide support in government circles, we need to know more about current labour market models, their usefulness in planning programmes and enrolments, and alternative measures for dealing with temporary manpower imbalances.

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27 Is the Die Cast? , p. 234.

28 Most notably in the Globe and Mail, 26 January 1982: "66% will discover university degree useless, report says".

2.0 ECONOMETRIC LABOUR MARKET MODELS: THEORY AND PRACTICE

2.1 General Methodology[1]

Two kinds of econometric models are generally used to forecast labour demand and supply: macroeconometric and occupational. Macroeconometric models, such as CANDIDE (Canadian Disaggregated Interdepartmental Econometric) developed by the Economic Council of Canada, and TRACE (Toronto Annual Canadian Econometric) developed by the Institute for Policy Analysis at the University of Toronto, are designed for labour market analysis at a highly aggregated level. The supply side estimates are derived from population data, and the demand side from total industrial output (Figure 1). Macroeconometric models currently in use in Canada do not disaggregate employment by occupation, and are therefore not directly used to determine highly qualified manpower requirements.

Occupational models, used for more detailed analysis and forecasting, draw on macroeconometric modelling for basic information on demand, by industry. These data are then converted to occupational demand, usually on the basis of historical data. (See diagram of a hypothetical model, Figure 2. Three major Canadian occupational models are described in more detail in the Appendix).

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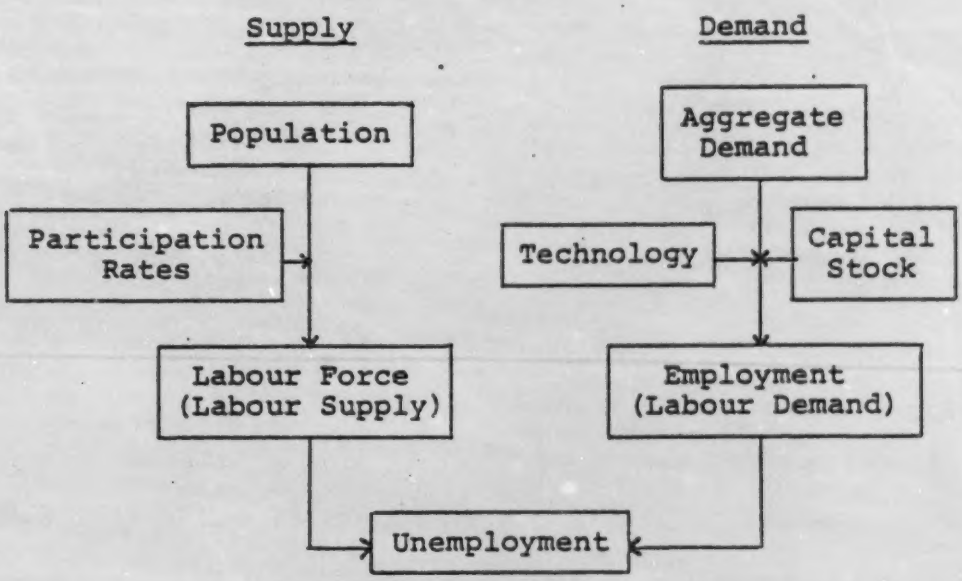
1 For the descriptions and diagrams of labour market models in this section and in the Appendix, I am indebted to a very useful report by David K. Foot, Labour Market Analysis with Canadian Econometric Models: A Review (Toronto: Centre for Industrial Relations, University of Toronto and Labour Market Information and Analysis Unit, March 1980).

FIGURE 1

SCHEMATIC OF THE GENERAL STRUCTURE OF THE LABOUR MARKET IN MACROECONOMETRIC MODELS



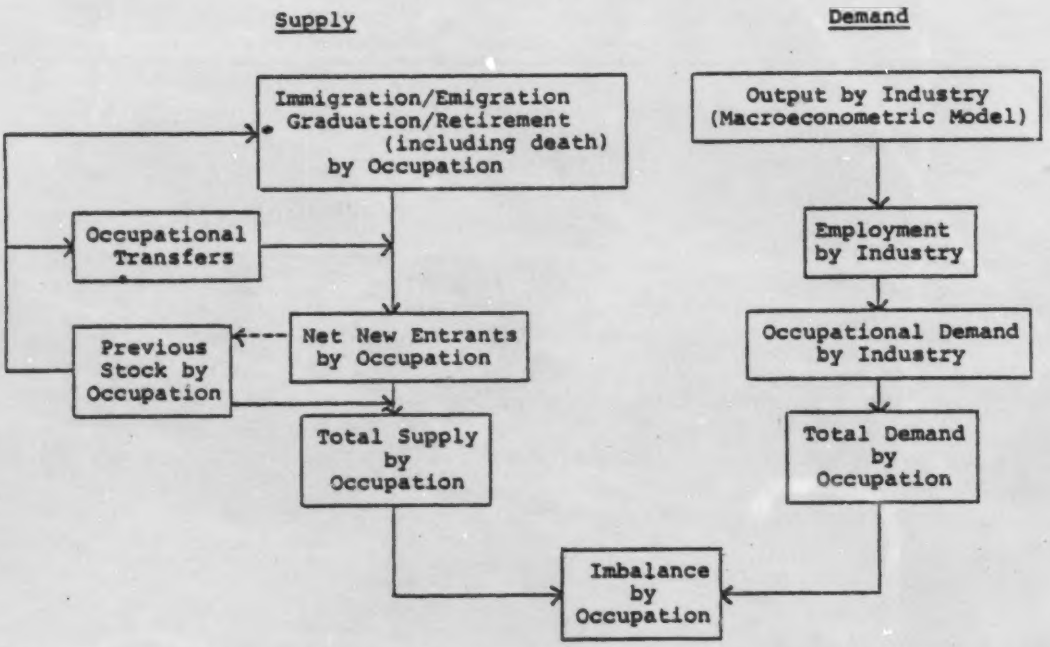
From: Labour Market Analysis with Canadian Econometric Models, Chart 1, p. 7.

On the supply side, the number of people currently employed in a given occupation (the stock) is adjusted to show additions such as new graduates, immigrants from other countries or provinces, and transfers from other occupations. Similar calculations are made to reflect decreases in the stock because of emigration, retirement, death, and transfers to other occupations. The difference between total demand and total supply (the residual) can then be ascertained. Unless the two sides are in equilibrium, the residual will be a labour shortage or surplus for that occupation.

As in the macroeconometric models, the structure may be conceptually complicated by influences from the residual imbalance on the basic components of supply or demand (the determinants). These interactions are known as feedbacks. For example, shortages of workers with specific skills may encourage immigration, and the resulting increased labour supply will affect future demand projections. The two sides of the labour market also interact: high demand may increase enrolments thus augmenting the supply of new graduates. As with the unemployment residual in macroeconometric models, a policy feedback is possible. Projected imbalances may produce a policy response (on either the demand or the supply side) designed to eliminate or minimize the imbalance. At present, both federal and provincial governments seem to favour policy responses that would alter the supply side. We need to know whether the projections derived from existing occupational models are sufficiently reliable to justify such intervention.

FIGURE 2

SCHEMATIC OF THE GENERAL STRUCTURE OF THE LABOUR MARKET IN OCCUPATIONAL MODELS



Note: A broken line indicates a delayed response (see text).

From: Labour Market Analysis with Canadian Econometric Models, Chart 10, p. 63.

2.2 The Limitations of Occupational Forecasting Methods

In spite of continuing refinements in the methodology of occupational forecasting, there are still significant limitations in the assumptions and data bases used in existing models. David Foot concludes his review of Canadian econometric models with a discussion of limitations and areas needing further research. He states that not one of the current generation of occupational models follows the basic structure of the hypothetical model shown in Figure 2. There has been a substantial difference between macroeconometric and occupational models in the treatment of interrelationships between supply and demand factors. In most macroeconometric models, these feedbacks both within the labour market and between the labour sector and other sectors are explicitly modelled. For example, within the labour market, employment prospects affect labour force participation rates. The political sector can have an impact on the labour market through policy decisions to correct imbalances (such as admitting fewer immigrants when unemployment is high). The supply data in macroeconometric models are essentially demographic, but data on the numbers of people employed in a given occupation in all industries (and whether there is a balance between this stock supply and demand at an appropriate wage rate) are less well known. None of the existing occupational models permits a calculation of stock imbalances. Thus, a consideration of feedbacks of this imbalance to other determinants (such as immigration) cannot be considered. In addition, occupational models have been constructed so that the output from the macroeconometric model influences the output from the occupational model, but not vice versa. Occupational

imbalances cannot influence immigration levels or sector outputs in the labour market represented by the model, although they obviously do in the real economy.

Changing technology and supply factors also affect the occupational structure of industries and the educational profile of persons employed in each occupation. However, occupational models must rely on fixed coefficients derived from surveys that may be out of date. None of the existing occupational models is designed to adequately capture inter-occupational mobility, yet this is a common phenomenon in the careers of university graduates. Engineers, for example, become managers. Again the models represent only partially the workings of the real labour market.

In summary, the main technical limitations of occupational models currently in use are:

1) Lack of accurate data on existing stocks of persons in occupations and fields of study;
2) Lack of data on interoccupational and interfield-of-study mobility;
3) Use of fixed share coefficients of occupational mix by industry;
4) Insufficient incorporation of feedbacks between supply and demand.[2]

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2 For a more detailed discussion, see Foot, pp. 102-107.

Although some occupations are highly education specific and thus theoretically more suited to this approach, practical experience with forecasting has had mixed results. The demand side of forecasts can be radically altered by unforeseen economic events, such as the mid-seventies energy crisis. The supply side is dependent on the collective choice behaviour of students who, in our educational system, make individual choices about level and field of education. Their decisions are not entirely determined by economic factors.

In addition to problems with technical assumptions and incomplete or obsolete data, occupational projections can be invalidated by unpredictable changes in the labour market. David Stager and Noah Meltz use the example of graduate nurses to illustrate the difficulty of matching supply and demand over time.[3] From 1968 to 1975, the nursing profession had a high rate of vacancy in Canada as a whole. In 1977 (when Stager and Meltz were writing), vacancies had almost been eliminated:

> Our suspicion in the absence of more concrete data and analysis is that a major factor contributing to this decline in vacancies was the large increase in salaries which took place for nurses, first in British Columbia in 1974, then in Ontario, and in other provinces subsequently.[4]

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3 "Manpower Planning in the Professions, "Canadian J. of Higher Education, VII-3 (1979), 76-77.

4 Ibid., 79.

The increase in salaries increased supply by inducing more nurses to remain employed, by attracting back those who had left the profession, and by increasing enrolments in nursing programmes. Stager and Meltz note that unless manpower planners had been able to anticipate the substantial increase in salaries of nurses, their forecasts would have overestimated demand and underestimated supply. Not long after the article was published, another policy intervention took place. An apparent oversupply of nurses in 1977-78 led to reduced enrolments in Ontario nursing programmes, thus precipitating another shortage.

Changes in projected requirements for scientific research personnel suggest that occupational forecasts should be used very cautiously in academic planning. In 1978, the Ministry of State for Science and Technology projected an oversupply of scientists in several disciplines through 1984:

> . . . significant decreases in the annual supply would be required at all levels in the health sciences and professions, engineering, the physical sciences and mathematics and at the bachelor degree level in the life sciences and biology before a state of equilibrium would be achieved.[5]

The MOSST data also indicated a moderate surplus of manpower in biology and other life sciences at the graduate level, of biochemistry at the bachelors level and of agriculture at all

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5 Unpublished data in Mary McGee and Walter Sudmant, The Demand for and Supply of Highly Qualified Manpower in Canada in the 1980s (Vancouver: UBC, 1980), p. 51 and charts 24-29.

degree levels. Small surpluses were shown for biochemistry at the graduate and forestry at all levels. Only three years later, in May, 1981, a MOSST document on scientific manpower describes current and continuing shortages in the same areas:

> Current labour market indicators show that there are shortages of specialized highly qualified personnel in many of the engineering specialties; computer sciences; specialties in the life sciences related to the diverse commercial applications of biotechnology, agricultural research, forestry and fisheries; the geosciences; and in management studies and administration.[6]

The market response of students to perceived and actual mid-to-late seventies surpluses is reflected in declining graduate enrolments in most pure and applied sciences, and the current widely-publicized concern over shortages. The National Science and Engineering Research Council set out a Five-Year Plan leading to a targeted expenditure of 1.5% of GNP for research and development by 1985. Now it appears that a critical shortage of research talent makes the attainment of this target very unlikely.[7]

Like researchers in the natural sciences, engineers are essential for the development of new high-technology industries. A current and perhaps continuing shortage of engineers has been attributed to the universities' failure to respond to the requirements of the economy. Since engineering manpower requirements have been studied by a number of university, government and professional agencies

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6 "Trends in Science Manpower" (MOSST, 26 May 1981), photocopy, p. 2.

7 "Background Information", (Ottawa: NSERC, July 1981), p. 3.

over the years, the assumption that university enrolments can be matched to anticipated labour market requirements can be tested by reviewing historical and current engineering manpower forecasts.

2.3 Engineering Manpower Projections

The long lead-time needed to significantly alter outputs in advanced academic and professional programmes is a major obstacle to the use of occupational forecasts in university programme planning. Social, economic or political events may intervene between the time a given level of demand is forecast and the time that demand is met. In the last decade, projected requirements for engineering graduates have had to be revised because they were based on assumptions that did not include the 1973 war in the Middle East, oil shortages, and the resultant increased demand for engineers in energy-related subdisciplines. Similarly, projections made one or two years ago may be invalidated by stabilized oil prices, and cancellation of energy projects. The situation could change again before students now choosing university programmes enter the labour market.

A time-series of engineering manpower projections is available in the reports prepared by E.B. Harvey and K.S.R. Murthy for the Technical Service Council.[8] Figure 3 is based on projected

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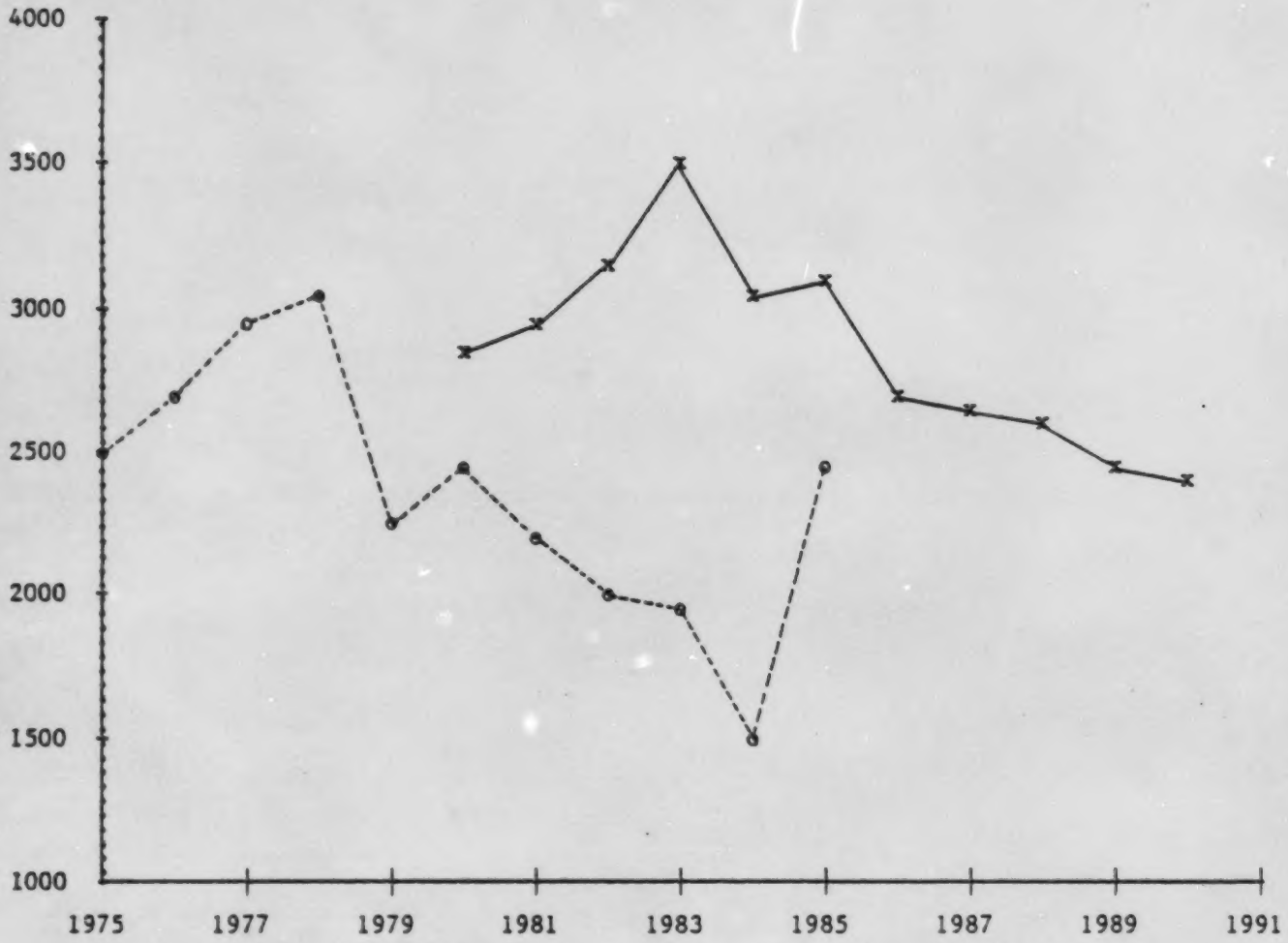
8 Supply of and Demand for New Graduates in Engineering, Chemistry, Business and Commerce (1975); Engineering Manpower Demand and Supply: Further Estimates (1976); and Supply of and Demand for Engineers in Canada (1980).

FIGURE 3

NET NEW DEMAND FOR BACHELORS' DEGREE ENGINEERS

TECHNICAL SERVICE COUNCIL PROJECTIONS, 1975 and 1980



----- Data from Supply of and Demand for New Graduates in Engineering, Chemistry, Business and Commerce (1975), Net new graduates required, Table 4-3, p. 22.

——— Data from Supply of and Demand for Engineers in Canada (1980), Net new demand (Bachelors' Degree), Exhibit 3:15, p. 32.

requirements for engineers with undergraduate degrees in the 1975 and 1980 TSC reports. The 1975 projection (broken line) anticipated a demand peak in 1978, and then a general decline in the early 1980s. The forecast made five years later (solid line) reflects expected growth in demand arising from various energy projects. In this projection, a peak of 3,500 new bachelors' degrees required compares to 1950 required for the same year in the 1975 forecasts. The diverging lines in the area of overlap in Figure 3 illustrate the uncertainty of occupational forecasts even within the five-year period that Harvey and Murthy consider the maximum range for projections of acceptable accuracy.[9]

Assuming moderate growth, (Table 5), the TSC reports also include projections of the supply of new engineers available through graduation and immigration demand is expected to exceed supply by approximately 1-2% in each year through 1985. The TSC forecast for masters' level engineers shows a consistent excess of supply over demand, with approximately 700 to 750 masters' degrees available annually from 1980 through 1985.(p. 39) It is expected that engineers with masters' degrees will be substituted for those with bachelors' degrees when the latter are in short supply. (p. 64)

According to Harvey and Murthy's 1980 projections, there would be no serious shortage of engineers in total during the first half of the 1980's. However, the projected imbalance was not foreseen in

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9 Supply of and Demand for Engineers in Canada, p. 64.

TABLE 5

TECHNICAL SERVICE COUNCIL ENGINEERING MANPOWER

PROJECTIONS (1980)

Moderate Growth Scenario	Projected Demand for Engineers (Bachelors' Degree)		
	Net New Demand	Replacement Demand	Total
1980	2,857	1,351	4,208
1981	2,929	1,405	4,334
1982	3,143	1,463	4,606
1983	3,502	1,528	5,030
1984	3,073	1,585	4,658
1985	3,100	1,642	4,742
Total	18,604	8,974	27,578

Moderate Supply	Projected Supply of Bachelors' Level Engineers		
	Net Supply[1]	Immigration	Total
1980	3,814	300	4,114
1981	4,038	300	4,338
1982	4,259	300	4,559
1983	4,482	300	4,782
1984	4,419	300	4,719
1985	4,631	300	4,931
Total	25,643	1,800	27,443

[1]Projected total degrees granted discounted by 34% to allow for further education, visa students returning home, emigration, employment in non-engineering occupations.

From: Supply of and Demand for Engineers in Canada, Exhibit 3:15, p. 32 and Exhibit 4:1, p. 38.

the 1975 report which anticipated an excess of supply over demand from 1979 through 1985. (chart 4:1 of the 1975 report)

The susceptibility of demand forecasts to changing economic conditions is apparent in two sets of projections from the Ministry of State for Science and Technology. The left side of Table 6, from a 1978 report,[10] shows projected demand for engineering graduates (all degree levels) through 1985. When this projection was made in March 1978, an average of 5,000 graduates would have been be required annually to meet demand for engineering and other HQM occupations in each year from 1979 through 1985. Annual requirements for the mid-eighties were actually expected to be lower than in the mid-seventies.

The latest MOSST paper on engineering requirements stresses a current and projected shortage of graduates.[11] As may be seen on the right side of Table 6, an average of about 7,500 graduates per year would be needed from 1979-1985, according to the 1981 projection, 2,500 more than was estimated in 1978. A total of 34,020 first degree graduates would be required, compared to 28,987 in the TSC Fast Growth Scenario projection for the same period.

Interestingly, the historical analysis of supply in the 1981 MOSST

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10 "The Demand for Engineering Engineering Graduates to 1985", Working Paper, second draft (Ottawa: MOSST, 1978).

11 The Requirements for Engineering Graduates to 1985, Background Paper No. 18 (Ottawa: MOSST, 1981).

TABLE 6

A COMPARISON OF MOSST PROJECTIONS OF REQUIREMENTS FOR ENGINEERING GRADUATES

Year	Total Engineering Graduates Required (All Degree Levels)		
	1978 Projection[1]	Year	1981 Projection[2]
1979	4,977		
		1979-80	7,050
1980	5,688		
		1980-81	7,200
1981	5,929		
		1981-82	7,450
1982	5,447		
		1982-83	7,650
1983	4,923		
		1983-84	7,850
1984	4,712		
		1984-85	8,200
1985	4,787		

[1]From: "The Demand for Engineering Graduates to 1985," Figure 1, p.6.

[2]From: The Requirements for Engineering Graduates to 1985, Table 9, p. 11.

report[12] does not include immigrants and Canadians returning home in the calculation of available engineering graduates, as was done in the equivalent analysis in 1978.[13] The 1981 report apparently reflects a federal policy of meeting manpower needs from domestic sources. The increase in visa student enrolments is discussed (pp. 5,6,8), but without reference to the possibility of allowing some of these graduates to work in Canada as a short-term measure for relieving the engineering manpower shortage.[14]

MOSST estimates of the expected engineering manpower shortage are shown in Table 7. The shortfall for engineers with graduate degrees is most dramatic, since visa students are apparently excluded from the supply estimates. Total domestic supply of first degree engineers (26,300) is within the same range as Harvey and Murthy's moderate supply for the same period (25,643), but as we have seen, the total requirement is much higher than either the 1980 TSC projections or those produced by MOSST in 1978. It is difficult to see how engineering enrolments could be adjusted to match such massive and sudden shifts in demand, if short-term solutions such as immigration are excluded.

Although Harvey and Murthy include some supply side forecasts in the major engineering subdisciplines (Appendix A:5 and A:6 of their

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12 The Requirements for Engineering Graduates to 1985, Table 7, p. 9.

13 "The Demand for Engineering Graduates to 1985", Figure 6, p. 14.

14 As recommended by the Ontario Council on University Affairs, OCUA Advisory Memorandum 81-V, pp. 12-13.

TABLE 7

ESTIMATED REQUIREMENTS AND AVAILABLE SUPPLY
FOR ENGINEERING GRADUATES

1979-1985

NUMBER OF GRADUATES

	FIRST DEGREE	GRADUATE	TOTAL
HQM Requirements	34,000	11,000	45,000
Supply (excl. imm.)	26,300	6,300	32,600
Imbalance	-7,700	-4,700	-12,400

Source: MOSST, HQM Model and Data Base, 1980.

From: The Requirements for Engineering Graduates to 1985, Table 10, p. 12.

report), they note that these projections are inherently more unstable than the total supply forecasts. For example, students may change specialization during their engineering studies as demand side conditions change. There is also no reliable data on the subdiscipline breakdown for immigrant engineers. (p. 210) These difficulties make it unlikely that imbalances for specific subdisciplines can be adequately adjusted on the supply side. Harvey and Murthy conclude with a suggestion for more flexible adjustments of demand:

> . . . many of the demands for engineering manpower are likely to be specifically delineated in terms of subdisciplines and types of experience. We are of the opinion that at the subdiscipline level there is no simple interchangeability among engineers and we therefore anticipate that concurrent surpluses and shortages of engineers, along subdiscipline lines, will occur during the forecast period. These circumstances suggest the need for Canadian employers to be flexible in their recruiting and to consider the retraining of engineers in those subdisciplines which prove to be in less demand. (p. 71)

2.4 Dealing with Manpower Imbalances

In its brief to the federal Task Force on Employment Opportunities for the '80s, the Canadian Engineering Manpower Council emphasizes the local and specialized nature of current manpower imbalances:

> A dynamic economy will always face shortages of engineers. Look at Alberta. At the same time, a careful distinction must be made between a general shortage of engineers and shortages within particular geographical areas and within particular disciplines and specialties. This seems to be the case today in Canada.[15]

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15 Engineering Manpower News, No. 26 (Jan. 1981).

The CEMC cites a Technical Service Council finding that two out of three engineers offered jobs in Calgary refuse them because of the high cost of living in that city, causing a shortage of engineers in the region. In other parts of the country, industries also have difficulty filling their requirements "although the problem does not seem to be so much an absolute shortage as it is a shortage of engineers with particular skills and years of experience." The CEMC and the Canadian Council of Professional Engineers are developing an Engineering Manpower Inventory which will improve information on the supply side. It is suggested that MOSST or the Canadian Employment and Immigration Commission should work on the demand side through more long term strategies for economic development, rather than attempting to fine-tune manpower supply.

While ackowledging that graduations from bachelor's engineering programmes are not keeping pace with the apparent short-term demand, despite modest but steady growth in enrolments, the CEMC does not advocate relieving the shortages of engineering faculty in isolation:

> We believe that solutions to those problems will come through adequate funding of university education, to the benefit of all faculty, including the engineering schools. There must be money for replacement of equipment, necessary and justifiable expansion of facilities, and fair salaries for faculty and support staff. Those provincial governments which have been devoting a decreasing proportion of their social expenditures to education must be reminded that deterioration of existing facilities is not easily reversed and will severely affect our national economic development.

The CEMC Brief also comments on some means of adapting to manpower imbalance. While cooperative education programmes such as

Waterloo's have been very successful, they should not be seen as a ready-made solution to perceived shortages:

> . . . shortages in engineering manpower are most often shortages of experienced engineers, not of student engineers, and an influx of those students into the workforce is unlikely to solve many existing problems. (Better advance planning by industries in their hiring would help ease their shortages of experienced engineers.)

Instead, the Brief suggests better utilization of technologists and technicians as part of an engineering team:

> The point here is that some problems of apparent shortages of engineering manpower are really problems of inappropriate utilization of that manpower. Our educational institutions are producing people with good engineering training. Employers need to use those people more effectively.

In general, the authors of the CEMC Brief see the current shortages of engineers in certain regions and specialties as part of an expected cycle that will be corrected as students respond to market demand, and as employers and the government, through immigration, make short-term adjustments.

> There will always be lag-time between the identification of a demand for engineering manpower and the satisfaction of that demand. The data collection process we supported earlier in this brief will help to lessen that lag-time. In general, we do not believe that disproportionate resources should be pumped into post-secondary science and engineering programs. Such action would hurt the general quality of post-secondary education and produce a range of new problems.

A short monograph by Neil Macdougall of the Technical Service Council also points out the effect of increasing specialization in the engineering market, with resulting highly specific shortages:

> Employers no longer seek chemical engineers or even chemical process engineers, but chemical process

> engineers with specific experience in petrochemical plant design, for example. Process plant design experience in other industries is thought unsuitable. This preference for related experience extends even to graduates with two to three years' experience, who in former times, would have been considered for training. Consequently, there is no longer a single job market for engineers, but rather about 50 sub-markets. Engineers in general will never again be in short supply. Rather, there will be shortages of various specialists while other specialists may be readily available.[16]

The TSC report suggests greater flexibility and advance planning to help employers cope with expected shortages of professionals. Several strategies are listed for increasing the supply of available candidates: hiring a larger percentage of trainees; reviewing utilization of engineers and accountants to ensure that they are doing professional work; reviewing the training of professional staff; establishing a manpower plan and keeping it up to date; and recognizing that professionals are adaptable. Macdougall emphasizes the latter point in his conclusion:

> It is worth remembering that the Concorde supersonic airliner and the Moon Lander were designed by engineers who had never done these things before. The great bridge failures and other engineering disasters were usually the work of experts. (pp. 12-13)

As has been shown in the above examples from engineering manpower studies, occupational projections are highly contingent on economic conditions that can alter within months, rather than years. Until more reliable methods are available, moderate and flexible

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16 Review of Professional Manpower (Toronto: TSC,1981), p. 7. Subsequent citations in parentheses.

adjustments may be the most appropriate response to highly-qualified manpower imbalances. Measures suggested for coping with shortages of engineers apply as well to other occupations employing university graduates. In a rapidly-changing economy, the broad general education provided by universities may be more valuable than narrow, job-specific training.

3.0 CONCLUSIONS

In its more general meaning, the concept of manpower planning is not in conflict with the ways universities have traditionally viewed their societal role. Few would question the benefits of more and better labour market information; the need to prepare graduates to function in all areas of a highly developed and increasingly technological economy; and the advantages of a smooth transition from education to working life. However, there is concern that some of the methods used to achieve these goals may be short sighted and may in fact produce less advantageous results than the essentially free (but ideally, informed) choice model now in use.

Although basic data on labour force participation, unemployment and salaries continue to show that the university-educated enjoy an advantage in the labour market, in the last decade graduates of certain programmes have had less positive first job experiences than earlier cohorts of graduates. The size of the baby boom generation, declining public sector employment, increasing participation of women in the labour force, and a less rapidly expanding economy have all contributed to this. Surveys of recent university graduates have confirmed that the job market has changed from the boom conditions of the sixties, although the extent of the change has often been exaggerated. Students and institutions have responded to this change with an increased emphasis on professional education. For example, between 1976-77 and 1981-82, full-time undergraduate enrolment in Ontario universities increased by 22.3% in engineering; by 83.3% in computer science; and by 87.8% in

commerce and administration.[1] Further expansion has been constrained by a shortage of qualified faculty and by general underfunding of the university system. Although the phenomenal growth in computer science jobs may be the exception, there is no compelling evidence that present university enrolments in job-related areas are not adequate to meet demand for the next few years.

This paper has reviewed the evidence used to support greater emphasis on the training aspect of higher education. Graduate surveys provide useful historical information on jobs obtained and on the short-term adjustments of new labour force entrants, but their results must be interpreted carefully. Occupational demand fluctuates, sometimes cyclically but not always predictably. Disciplines in high demand at the time of a survey will not necessarily be in high demand by the time the next cohort of graduates enters the job market. By overstating the case for job-related education, a report like Job Market Reality for Postsecondary Graduates may encourage government and prospective students to opt for a few professional programmes which cannot realistically be expanded beyond present capacity.

There may be other solutions than massively increased output in particular disciplines. More flexible adjustments of both supply

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1 COU surveys of undergraduate enrolment in Commerce and Administration, Engineering and Computer Science, July 1981 and March 1982.

and demand sides would help graduates, institutions and employers. For example, on the supply side, mathematics could be made an accepted part of the liberal arts curriculum, and instruction in computer science languages could be available to all students regardless of major. Combined majors like the University of Western Ontario's Administrative Studies programme would allow students to pursue interests in the social sciences and humanities and still acquire job-related training. These programmes should augment, but not replace traditional academic programmes.

On the demand side, employers could solve some of the problems of perceived shortages if they looked beyond degree specialty and hired on the basis of ability and capacity to learn. Some jobs obviously require specialized skills and knowledge, but for many entry-level jobs, substitution should be possible.

Ultimately, the amount of instruction that can be provided in high-demand areas is limited by a shortage of qualified faculty. Solutions to this problem are long-term, and may well require the provision of greater support to the entire university system, rather than simply the targeted increases suggested by the Dodge and Allmand reports. Unless fundamentally secure in the pursuit of their basic mission, the university institutions of this province will lose the ability to pursue any more specific mission that may be assigned to them.

Finally, the advocates of greater intervention in the interests of manpower planning should consider more than the short-term requirements of the labour market. The methodology of occupational fore-

casting is still underdeveloped. As has been shown, reliable forecasts three or four years in the future have not yet been produced. The universities have already made significant reallocations of resources toward professional education, with resultant increases in enrolment in areas like business, computer science and engineering. We are skeptical of the government's ability to improve on this, and question the need, from available evidence, to do so.

Appendix
CANADIAN OCCUPATIONAL MODELS

COFOR (Canadian Occupational Forecasting) is maintained by the Labour Market Supply and Demand Analysis Division of Employment and Immigration Canada. In its most recent forecasts (COFOR 85), demand projections are made for some 500 occupations, including those employing university graduates.[1] Figure A-1 shows the basic components of the COFOR model. The first step is the delineation of several macroeconomic scenarios for Canada, projecting a range of possible values for key labour market variables. The Canadian base projection is then provincialized, and the projected employment levels dissaggregated into industrial sectors. Estimation of required occupational stocks is obtained by multiplying occupation-by-industry proportions from the 1971 Census (the most recent complete data available) by the industrial employment projections. Further calculations are made to derive occupational needs due to growth and replacement.[2]

The HQM Model

The HQM (Highly Qualified Manpower Model) was developed by the Ministry of State for Science and Technology to project required graduates of post-secondary institutions by level of educational

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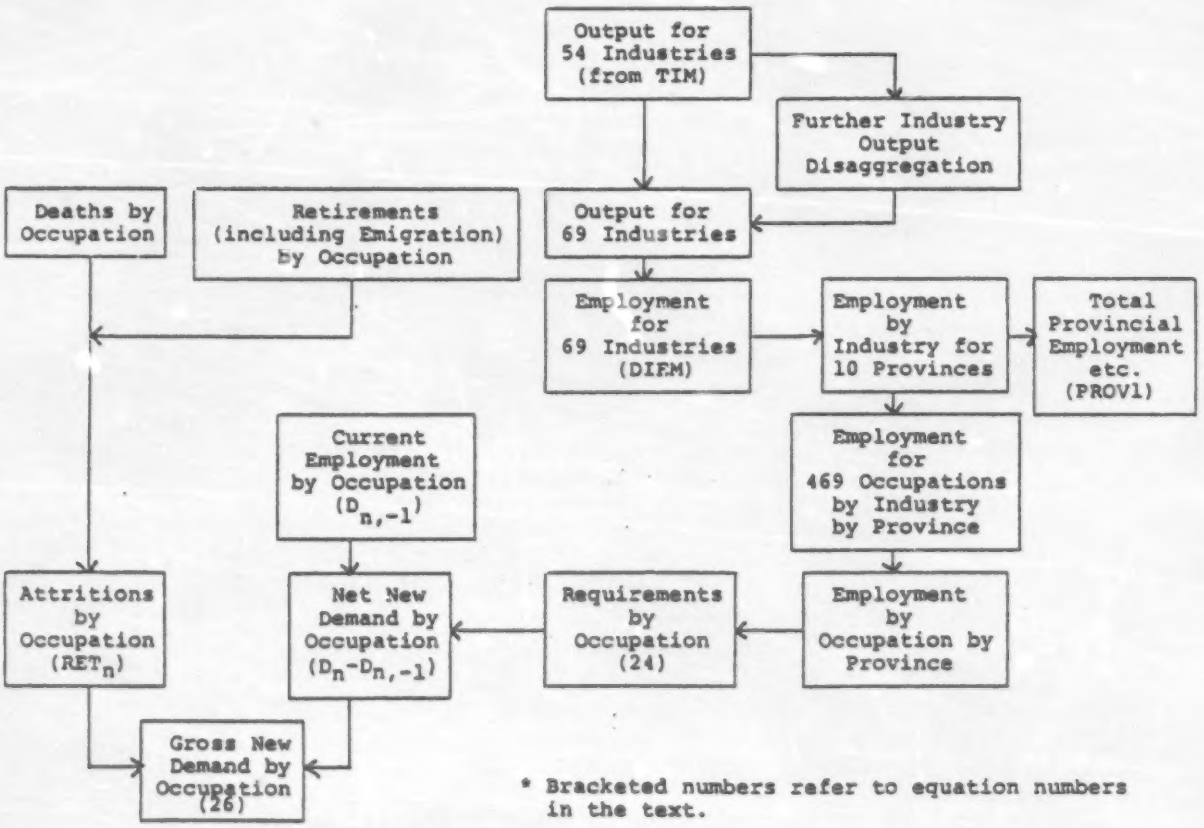
1 Canadian Occupational Forecasting Program (COFOR), Occupational Requirements to 1985 (Ottawa: Dept. of Employment and Immigration, Feb. 1981).

2 Ibid., pp. 5-6.

FIGURE A-1

SCHEMATIC OF THE STRUCTURE OF THE COFOR MODEL*


Output for 54 Industries (from TIM)
Further Industry Output Disaggregation
Deaths by Occupation
Retirements (including Emigration) by Occupation
Output for 69 Industries
Employment for 69 Industries (DIFM)
Employment by Industry for 10 Provinces
Total Provincial Employment etc. (PROV1)
Current Employment by Occupation ($D_{n,-1}$)
Employment for 469 Occupations by Industry by Province
Attritions by Occupation (RET_n)
Net New Demand by Occupation ($D_n - D_{n,-1}$)
Requirements by Occupation (24)
Employment by Occupation by Province
Gross New Demand by Occupation (26)

* Bracketed numbers refer to equation numbers in the text.

From: Labour Market Analysis with Canadian Econometric Models, Chart 12, p. 77.

attainment and field of study.[3] The model (Figure A-2) distinguishes three classes of HQM: health, education and technological. Requirements for the seven occupational groups in the health sector are related to the age-sex characteristics of the population at large. Projections for the 70 occupational groups in the education sector are also related to demographic information. Factors such as post-secondary participation rates, enrolments by discipline and student-teacher ratios enter into the calculation of university teacher requirements. Occupational requirements in the technological submodel are obtained largely according to the COFOR methodology, with the CANDIDE model used to obtain projections of employment by industry for the twelve major industrial sectors.

After some further disaggregation, employment by industry is translated into 68 occupational groups using industry-occupational coefficients based on the 1971 census and 1975 Statistics Canada Occupational Employment Survey information.[4] No provincial disaggregation is incorporated in the model, in part because of the high degree of mobility in HQM occupations. An attrition submodel generates estimates of replacement demand arising from mortality, retirement and emigration. Gross new demand by occupation is the

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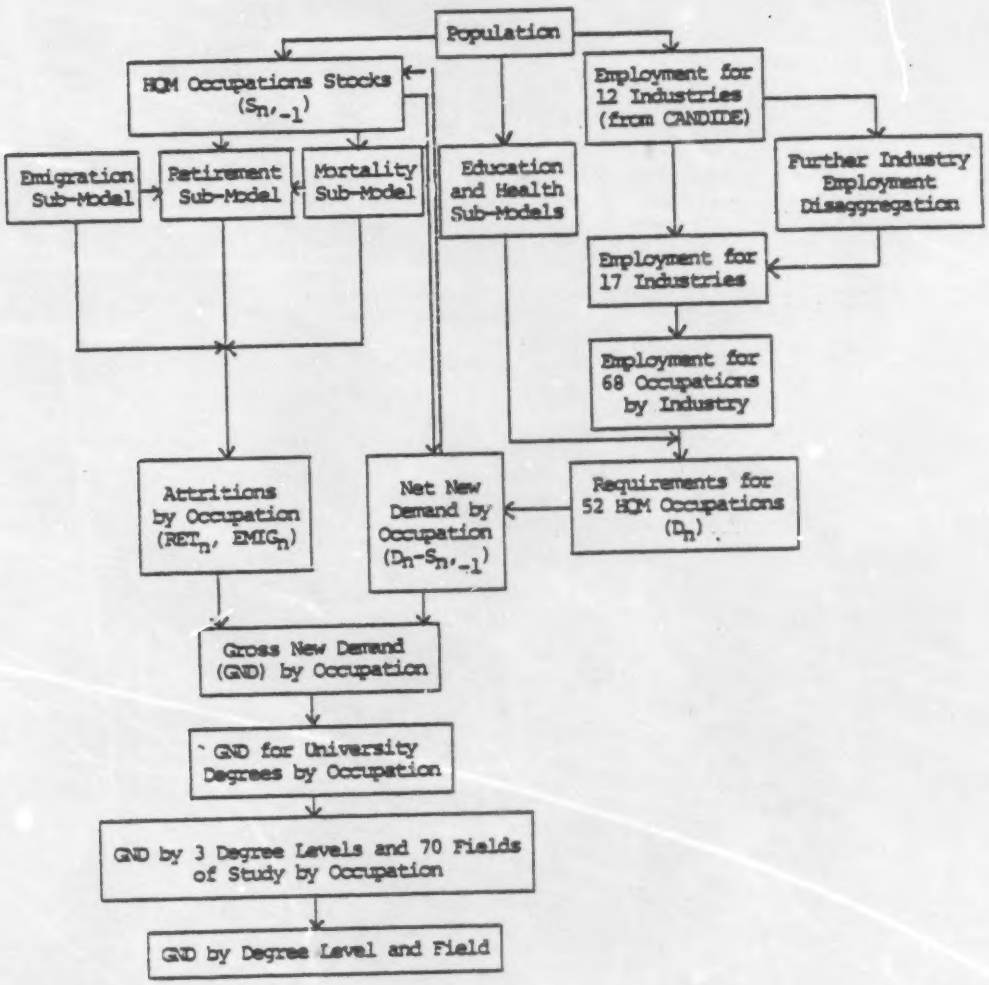
3 For a more detailed description, see "Methodology: MOSST HQM Demand Model", Working Paper, MOSST Forecasting Division (Ottawa: June 1978).

4 Foot says that the accuracy of the OES data have been questioned. The use of fixed industry-occupational coefficients is a central problem in forecasting demand when technology and educational requirements are changing rapidly.

FIGURE A-2

SCHEMATIC OF THE STRUCTURE OF THE HQM MODEL


Population
HQM Occupations Stocks ($S_{n,-1}$)
Employment for 12 Industries (from CANDIDE)
Emigration Sub-Model
Retirement Sub-Model
Mortality Sub-Model
Education and Health Sub-Models
Further Industry Employment Disaggregation
Employment for 17 Industries
Employment for 68 Occupations by Industry
Attritions by Occupation (RET_n, $EMIG_n$)
Net New Demand by Occupation ($D_n - S_{n,-1}$)
Requirements for 52 HQM Occupations (D_n)
Gross New Demand (GND) by Occupation
GND for University Degrees by Occupation
GND by 3 Degree Levels and 70 Fields of Study by Occupation
GND by Degree Level and Field

From: Labour Market Analysis with Canadian Econometric Models, Chart 13, p. 87.

sum of new requirements from the three submodels and replacement demand from the attrition submodel. Supply is not estimated, so an assessment of occupational imbalances is impossible.

The HQM model includes an additional feature, the translation of total demand by occupation into requirements for university graduates by level (Bachelors, Masters or Doctorate) and by field of study. The proportion of jobs in each occupation that is filled by university graduates is calculated using the 1971 Census data. Adjustments are made to reflect trends over time. The HQM Post-Censal Survey of 1973 is used to translate the requirements for university graduates into level and field requirements. Additional 1975 Statistics Canada data is included in the calculations for university teachers. The resulting three dimensional (occupation-specialty-level) coefficient matrix is alleged to enable occupational requirements to be translated into university degree requirements by field and level.

The TSC Model

The third occupational model most often cited in Canada was developed by Edward Harvey and K.S.R. Murthy for the Technical Service Council, a non-profit placement service and personnel consulting firm run by industry. The TSC has published studies on engineering, chemistry, business and accounting.

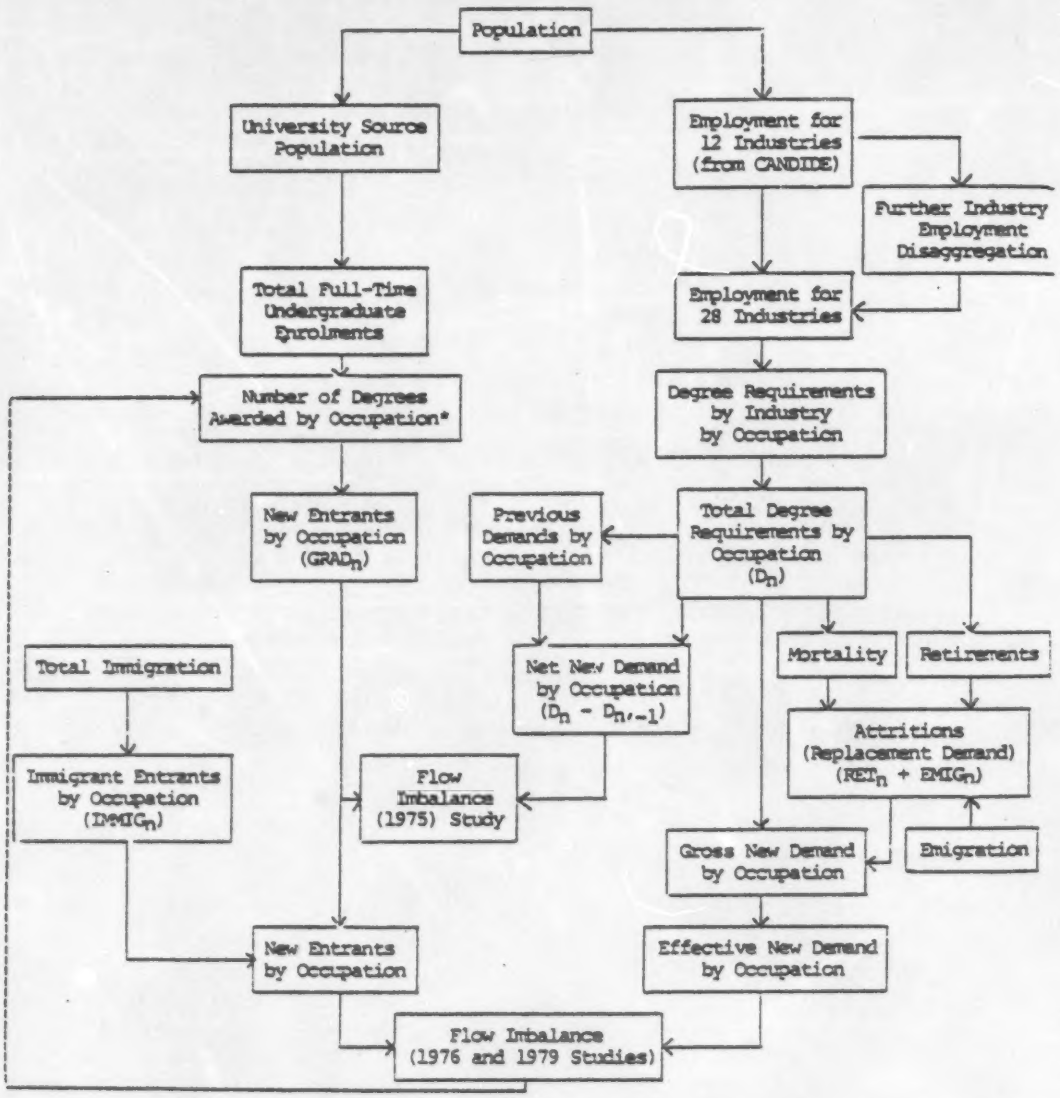
Like COFOR and HQM, the demand side of the TSC models begin with CANDIDE projections of employment for each of the major industrial sectors in the Canadian economy. Data from the 1973 HQM survey are used to calculate the proportion of degree holders in a given

occupation by industry. Some "judgemental" adjustments are made to reflect changes during the forecast period, such as higher academic requirements for new entrants. After summing over all industries, total degree requirements for each year are produced. An estimate of net new demand is derived from the annual differences in these stock requirements. Estimates are also made for demand created through attrition (decreases in the stock due to death and retirement). The total demand estimates (growth plus replacement for attrition) are adjusted by high, moderate and low demand factors, producing three possible demand scenarios.

Unlike the COFOR and HQM models, the TSC methodology includes estimates of new entrants through graduation and immigration (the supply flow) to complement the demand estimates. Projections of population by age and sex are used to determine the source population for new university entrants. Using historical data, these are converted into full-time undergraduate enrolments and graduations in the relevant disciplines. (See the left side of Figure A-3.) The total estimates for new graduates are discounted by high, moderate and low supply factors to allow for continuing education, return of visa students to their home countries, and delayed entry to employment. Although the model still does not account for interoccupational mobility, it is possible to determine the flow imbalance under each of the three supply and demand scenarios by calculating the difference between the two sides of the equation. However, since nothing has been assumed about initial or final stock imbalances, it is impossible to assess the stock imbalance for each occupation over time. The most recent TSC

FIGURE A-3

SCHEMATIC OF THE TSC'S MODELS DEVELOPED BY HARVEY AND MURTHY


Population
University Source Population
Employment for 12 Industries (from CANDIDE)
Further Industry Employment Disaggregation
Total Full-Time Undergraduate Enrolments
Employment for 28 Industries
Number of Degrees Awarded by Occupation*
Degree Requirements by Industry by Occupation
New Entrants by Occupation ($GRAD_n$)
Previous Demands by Occupation
Total Degree Requirements by Occupation (D_n)
Total Immigration
Net New Demand by Occupation ($D_n - D_{n,-1}$)
Mortality
Retirements
Attritions (Replacement Demand) ($RET_n + EMIG_n$)
Immigrant Entrants by Occupation ($IMMIG_n$)
Flow Imbalance (1975) Study
Gross New Demand by Occupation
Emigration
New Entrants by Occupation
Effective New Demand by Occupation
Flow Imbalance (1976 and 1979 Studies)

* Other determinants not noted on this Chart enter these equations.

From: Labour Market Analysis with Canadian Econometric Models, Chart 14, p. 98.

study projects supply and demand through 1990 for bachelor's and master's level engineers.[5]

The COFOR, HQM and TSC models all analyze manpower for the country as a whole. Individual provinces are also experimenting with econometric modelling. The Ontario Manpower Commission is developing a provincial version of the HQM model.[6] The Commission's avowed intention is to develop a capability for projection so that users can interact with the models and develop their own forecasts. Projections of both demand and supply through 1986, and some analysis of possible imbalances have been published in Labour Market Outlook for Ontario, described earlier.

In Alberta, the Planning Secretariat of the Department of Advanced Education and Manpower is adapting the COFOR methodology provincial projections.[7] Alberta is aiming at an "informed choice model" for university planning. Information derived from the model will enable students to make better choices based on occupational prospects five years in the future. The Alberta research is concentrated on the demand side. Currently, work is being done on the conversion of occupational demand into discipline demand, with

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5 E.B. Harvey and K.S.R. Murthy, Supply and Demand for Engineers in Canada (Toronto: TSC,1980).

6 Information from a conversation with Dr. Farid Siddiqui, Director of The Labour Market Information and Analysis Unit, Ontario Manpower Commission, 18 Sept. 1981.

7 Information from a telephone conversation with James Corneil, Executive Director of Employment Services, Dept. of Advanced Ed.

emphasis on education or skills required, rather than simply occupational title.

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